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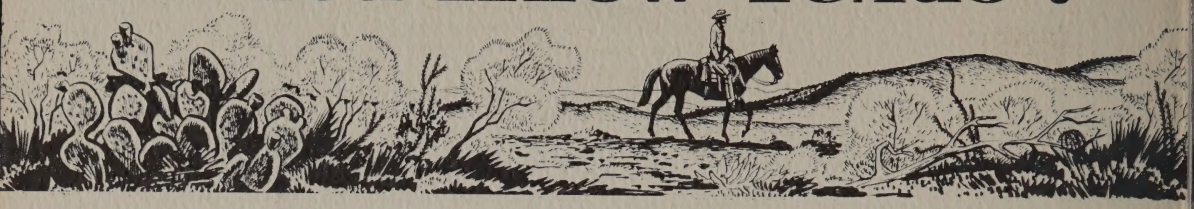
TEXAS Highways

February, 1956

Do You Know Texas ?



Texas has 370 miles of salt water shore line, all of which offer good fishing to those who like the sport. As with everything else an angler does not have to be rich, all he requires is a little time and a little patience. Among the most favored spots along the coast are these jumbles of piles and boulders jutting out into the waters of the Gulf of Mexico. This jetty is at Port Isabel in Cameron County and is one of the many attractions to summer and winter visitors in the subtropical Rio Grande Valley.

As any of the regulars along this jetty can tell you, you can catch anything you're man enough to handle from tarpon to flounder, and certainly anything you can hook from an expensive charter boat. Each year about the middle of August a fishing tournament and rodeo is held with prizes for all the whoppers.

Port Arthur, Freeport, and other coastal cities have gone even a step further in providing comfort for its visiting fishermen. The jetties there are paved on top and are known as the sidewalks of the sea.

About the Cover . . .

Probably the most famous civil engineer this country has produced is no less a personage than George Washington himself who appears on the cover. His early career has become completely overshadowed by the militarist and statesman, but he never ceased to be interested in all things scientific. During his term as president he expressed the opinion that he believed in the future development of air travel.

The nation will celebrate National Engineers Week beginning February 19, and today's engineers like to point out that during his early military career, the father of our country planned and constructed many roads, blockhouses, stockades, and forts. One of his wilderness roads was eventually to become the great coast-to-coast highway, U.S. 40. Our story on Page 3 describes civil engineering today.

VOL. III

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TEXAS Highways

The purpose of this publication, "Texas Highways," is to furnish a medium for presenting practical ideas and information. Employees are invited and urged to submit suggestions and relate experiences which would benefit or be of interest to Highway employees. These conclusions and data are not necessarily endorsed by the Highway Department nor are they to be construed as instructions.

Photographic services are available and other assistance may be obtained, if desired, in preparing material for submission. All material and comments should be directed to the Information and Statistics Division, Austin 14, Texas.

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COMPILED AND EDITED
Information and Statistics Division

New Memorial Marker

U.S. 90 west of Houston was dedicated as a part of the Blue Star Memorial Highway in a short ceremony recently. The highway is a tribute to the armed forces that have defended the United States and is a project of the National Council of State Garden Clubs. The garden clubs in the various cities designate the routes and buy the markers and the Highway Department maintains them. This marker, about two miles west of Houston, was provided by the Houston Council of Texas Garden Clubs, Inc. Gene Coddou, left, Maintenance Foreman; Lonnie T. Mings, Senior Maintenance Superintendent; and Lester J. Pruitt, Senior Landscape Architect; represented the Highway Department at the dedication ceremony.

A Salute to

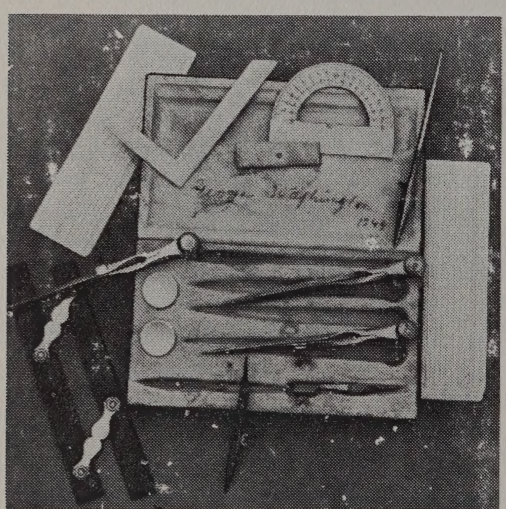
Engineering

Herbert K. (Hub) Rigsbee, Senior Office Engineer, Bridge Division, has been active in engineering organizations ever since he entered the field. He has held every office in the Travis Chapter of the Texas Society of Professional Engineers and is now president of the Austin Ramshorn Club which is composed of ex-students of the University of Texas College of Engineering.

Recently a group of officers of the Texas Society of Professional Engineers met with Governor Allan Shivers to witness the signing of an official proclamation designating the week of February 19 through 25 as "Engineer's Week." This particular week was chosen for emphasis on the engineering profession because of the important national holiday, Washington's Birthday. Due to his military genius, and tremendous contributions to the political life and thinking of our nation, few people realize that the "Father of our Country" was one of the outstanding engineers of his day. Prior to his gaining prominence as a military leader in the French and Indian Wars, and later in the American Revolution, he did extensive surveying throughout Virginia and the Ohio River Valley, locating a highway through the Appalachian Mountains, which later was to become one of the main routes of travel for the great western migration of the late Eighteenth and early Nineteenth Centuries. He made hydraulic and navigation surveys of the upper Ohio River. River development installations, such as dams and locks, are today at approximate locations suggested in the notes of early surveys made under Washington's direction—monuments to the engineering genius of this great and rugged individualistic American. We in the engineering profession owe a debt of gratitude to this great American, George Washington, who was America's first great engineer as well as its first great President.

At one time engineering was strictly a military function carried on by military personnel, and as a consequence, construction was largely of a military nature such as ramparts, fortifications, roads for the transport of military supplies and equipment, and the building and maintenance of water supplies to furnish this most

necessary commodity to cities and fortified areas resisting enemy attack. During the development of areas for trade purposes, the necessity for public works of a similar nature became apparent, and individuals outside the military took up the design and construction of these facilities and were known as "civil engineers," to distinguish them from engineers attached to the military. This was the designation, or name, of the parent group from which many technical specialists have developed. In other words, the civil engineer was the original engineer of civil life. With the application of steam, and later electricity, as motive power in the industrial development of Western Europe and the United States, the mechanical and electrical engineers separated from the parent civil engineer group. Today, with our complex industrialization with many highly specialized branches, we have, here in Texas, fourteen different classifications under which engineers are licensed to practice ranging from the original civil engineer, through mechanical, electrical, geological, and petroleum. Because all of these classifications have their roots in the natural sciences, there is of course much overlapping, and in many cases no clear line of demarcation between one branch and another.



George Washington used these very drawing instruments as a young man in his surveying and map drawing work. These carefully preserved instruments at Mount Vernon could be used today by engineers and draftsmen.

On March 18, 1937, the newspapers of the nation reported that a gas explosion the day before had killed 284 children and 14 school teachers who were at school in New London, Texas. The school district was wealthy. The school was new. The officials of the school district had honest motives and business economy in every action they took. They were respected leaders of the community. But, the planning and installation of the gas utilities in that school had been done by individuals lacking in technical knowledge necessary for the proper design and installations of such facilities.

The shocking disaster helped the Forty-fifth Legislature of Texas in its decision to enact a law for the registration of professional engineers in the State of Texas. Texas was the thirty-eighth state to enact such legislation.

The New London School disaster was the event that stirred the people of Texas out of their lethargy into the sudden realization of the need for such a law. It is the unfortunate truth that it sometimes is necessary for such a horrible thing as this tragic disaster to occur before a people can be shaken into consciousness necessary to enable them to pass legislation to prevent something like this from happening. Making such a law was like "locking the door after the horse had been stolen," but fortunately, since the passage of Senate Bill 74, better known as the Engineer's Registration Act, no other "horses" have been stolen in Texas to date.

"In order to safeguard life, health and property" of the people, this law was enacted. It is designed to protect the public from being swindled and preyed upon by individuals posing as engineers and doing work that requires engineering training who are not capable of performing such work. The

minimum qualifications an engineer must have in the way of education and experience are delineated. For those individuals aspiring to be engineers who have not had the benefit of a formal engineering education, the law provides that examinations may be given to determine their proficiency in the field in which they propose to practice.

The Registration Act further states what types of works come under the jurisdiction of the act, and that the plans for such works must have been prepared by, and the work constructed under the supervision of a registered professional engineer, and the plans must carry his seal.

This act has been in the statutes since 1937, and in those eighteen years, it has become apparent that there are a few clauses and sections that need strengthening. Consequently, the act has recently been partly rewritten and it is proposed to submit this revised version of the act to the next session of the legislature for their consideration.

Engineering is not a new science. When the first cave man tied a rock to the end of a stick to make his stone axe, whether he knew it or not he was doing a sort of engineering for by so doing he was not only using the principle of the lever, but he was also applying centrifugal force, momentum, and kinetic energy as forces of nature to make his life easier. And so it has been, down through the ages, man using his ingenuity to devise structures and machines to make his existence on earth more tolerable.

During the expansion of the Roman Empire, engineering made some enormous strides, and it was not an accident that this period should produce some monumental structures. When the Roman armies were not out on missions of conquest, it was a part of their function to build fortresses, ships, war machines, and such structures that were both for the benefit of the Roman army and the cities in which these armies were garrisoned. As these cities grew in population, an adequate water supply became an urgent necessity of the famous aqueducts found all over the Roman Empire. The fact that some of these aqueducts are still practically intact today is a tribute to their masterful construction. As the Roman Empire spread over almost all of Europe as we know it today, it was necessary to establish lines of communication between Rome and the outlying provinces. A system of roads was built over the country to speed communications and to supply the armies as well as aid the civilian communities in their transportation from one town to another. Although these Roman roads were built only to carry horse-drawn and pedestrian traffic, they were built to endure. The most famous of these, the Appian Way, has endured the centuries and a good portion of this remarkable structure is in use today.

Recently, the American Society of Civil Engineers selected the Seven Modern Wonders of American Engineering. This was no easy job, as there are literally thousands of projects in our great country worthy of consideration, and it took three years to complete the selection. Size was not enough to establish a project as a wonder, as the Society considered the extent of a project's service to people and communities as its first criteria. The second factor was uniqueness; third, the extent of pioneering demonstrated in design and construction; fourth, extent to which the work has been successfully copied; and fifth, outstanding values, both aesthetic and utilitarian. Size came last.

Here is the list:

1. Chicago's Sewage Disposal System, a herculean task in sanitation.
2. Colorado River Aqueduct, the longest man-made conduit.
3. Empire State Building, the queen of skyscrapers.
4. Grand Coulee Dam and the Columbia River Basin Project, an irrigation marvel.
5. Hoover Dam, the world's

highest dam.

6. Panama Canal, a cut linking two oceans.

7. San Francisco-Oakland Bay Bridge, a unique over-water steel structure.

By way of comparison, Reader's Digest, in their November, 1955, issue lists the Seven Wonders of the Ancient World as selected by Antipater of Sidon about 200 B. C.

1. The Pyramids of Egypt—the only one surviving.

2. The Hanging Gardens of Babylon--only their remains have been discovered.

3. The Statue of Zeus at Olympia—a seated figure 40 feet high.

4. The Temple of Artemis at Ephesus--has some columns 60 feet high.

5. The Mausoleum at Halicarnassus—140 feet high and with a circumference of 411 feet.

6. The Colossus of Rhodes—a metal statue of the sun god said to have been 160 feet high.

7. The Pharos of Alexandria—an early lighthouse said to have been about 370 feet high.

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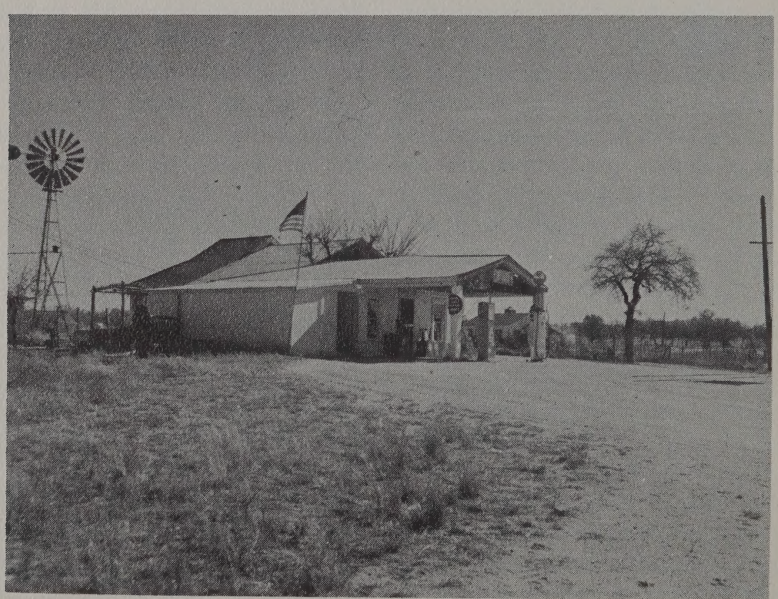
What's in a Name?



Located on State Highway 29 about six miles northwest of Mason, this is the community that early residents had hoped would one day grow into a thriving metropolis. But the picture below includes all of the present town of Grit—one building that serves as store, service station, and post office for some 30 residents of the community. Those pioneers who stuck it out here had great perseverance, and from this the community derived its colorful name. The gritty soil of the area also played a part in the selection of the name.

WASHO road test

M. D. Shelby, Supervising Research Engineer
Road Design Division

The value of the recently adopted Departmental policy of recommending sealed shoulders for heavy-traffic highways in Texas and of the triaxial method of flexible base design as developed by our Materials and Tests Division is testified to by results of the WASHO Road Test. The final report on the test has recently been released and contains much information of value to highway planners.

The primary objective of the project was to determine the effect of controlled test traffic upon flexible-pavement structures ranging from six inches in thickness--representing a number of existing highways—to twenty-two inches in thickness, representative of designs 25 per cent greater than those considered normal for the climate, soil, and paving materials at the project site for assumed traffic consisting of 4,000 vehicles per day including 1,000 commercial vehicles, 400 of which were three-axle trucks or heavier.

Such a test had been requested in June, 1951, when the Western Association of State Highway Officials passed a resolution asking the Highway Research Board to supervise the construction and testing of a road to determine the effect of various axle loads on certain designs of flexible pavements. From this beginning, the project developed into an enterprise of major proportions jointly sponsored by the Territory of Alaska; the states of California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming; the Bureau of Public Roads; twenty-three petroleum companies; seven motor truck manufacturers; and nine truck-trailer manufacturers. The over-all direction of the project was under a 31-member Advisory Committee on which Texas was represented by State Highway Engineer D. C. Greer. The field personnel during both construction and testing operations was under the supervision of Project Engineer W. N. Carey Jr. of the Highway Research Board.

The location near Malad in southeastern Idaho was chosen as representative of the climate and soil of the western United States. Special pavement sections were built in the summer of 1952; traffic testing got

underway on November 6, 1952, and was continued intermittently until May, 1954. Traffic was operated eighteen hours daily, with the shifts rotated so that sometime during the test all hours of the day would be covered by traffic operation.

A special effort was made to record and assemble all information possible dealing with climate, since climatic environment plays an important part in the ability of a pavement to support load. The test period was drier than normal for that area, so there was even an effort to simulate rain. In July, 1954, after completion of the regular testing program, a special study was made in an attempt to determine whether a "critical" condition could be induced by simulated rain. A part of one of the sections that had no visible defects was selected for a twelve-day test. However, the test was not very successful.

Principal findings of the project may be summarized as follows:

1. Surfaced shoulders contributed significantly to improve the life of the road by better controlling moisture fluctuations in supporting soils. A fourteen-inch road structure with surfaced shoulders is equal to an eighteen-inch road structure with open shoulders.

2. Results indicate that with the same total road structure thickness, the four-inch asphaltic concrete section was significantly better than the two-inch asphaltic concrete section. This result indicates the importance of providing high-type material of adequate thickness directly under heavy wheel loads.

3. Other factors held constant, the road life varied inversely with the amount of applied axle load.

4. Deterioration of base was directly connected with increase of

Aerial view of test loops in Malad Valley near Malad, Idaho.

basement soil moisture.

5. The very excellent showing of Texas in estimating the required road structure thicknesses for the various axle loads as compared with the other seventeen states that submitted estimates.

According to the report, probably two of the most important findings of the test, as to the use that may be made of them in highway design, are Numbers 1 and 2—those dealing with benefits of paved shoulders and thicker surfacing.

"Failures were noted early in the spring of 1954 in the parts of some sections that had not been provided with paved shoulders," the report states. "It was not until many more heavy-axle loads had been operated that any significant failures were noted in the parts of those sections with paved shoulders, and even at the end of the test the visible evidence of the protection afforded by the shoulder pavement was striking."

Texas' estimates ranked at the top of the list of recommendations submitted by the eighteen participating states. In advance of the test, samples of the basement soil and gravel to be used for subbase and the base material were sent to each of these states and each was asked to recommend a thickness of subbase to adequately support the four axle loads under a set traffic pattern for each of two surface thicknesses as follows:

(1) two-inch asphaltic concrete over four inches flexible base

(2) four-inch asphaltic concrete over two-inch flexible base.

The four axle loads were 18,000 pounds single, 22,400 pounds single, 32,000 pounds tandem, and 40,000 pounds tandem. Design thicknesses of the pavement structure submitted by the states for these conditions averaged about eighteen inches.

From an engineering analysis of the test results, the final report gives the minimum subbase thickness that would have been adequate to carry each of the eight conditions of axle load and surface thickness. These minimum thicknesses were compared with the depths previously estimated by the eighteen states and a comparative scoring was arrived at in the following way:

1. An estimated depth which was exactly equal to the thickness determined by the test was scored 100 per cent.

2. The estimated depth which missed the thickness determined by the test by the greatest amount either over or under was scored 0 per cent.

3. All other estimated depths were scored percentagewise between these extremes.

4. Each state's scores for the eight conditions were then averaged.

With scoring on this basis, Texas rated 92.25 per cent, the highest score. The second highest was 81.13 per cent and the scores ranged on down to a low of 2.25 per cent.

It was indeed gratifying to note that the maximum deviation for the estimated thicknesses submitted by Texas as compared with the thicknesses determined by the test was a three-inch overdesign for the 22,400-pound axle load for the four-inch-thick asphaltic concrete surface. Two of the Texas estimates coincided exactly with the test results, two were one inch underdesigned, one was one inch overdesigned, one was two inches overdesigned, and one was one and one-half inch overdesigned. These results speak very well for the triaxial method of determining flexible base design which was developed by engineers of the Texas Highway Department.

There are a number of other interesting facts to be derived from the test results and the complete final report is recommended reading for those interested in pursuing the facts concerning a rational approach to flexible pavement design. Copies of the final report should now be in the hands of all District Engineers.

STORM SCREENS

O.B. Seabourn, Senior Equipment Supervisor
District 8

District 8 recently expanded its facilities at Abilene to include a new duplex Resident Engineer's Office Building with basement, which provides space for the District right-of-way personnel and a general assembly room, plus office space for two Resident Engineers' organizations.

The building was of masonry construction and a thing of beauty, we thought—but there was obviously a very important omission--protection from hail storms for the casement windows.

In this part of the state the spring seasons frequently bring severe hail storms. In 1950 one storm broke 197 windows and damaged roofs on warehouse buildings to the extent of $400 for repairs at our Abilene installation. Immediate action was necessary since there were 24 four-by-six-foot windows in the new building fully exposed.

Cost of metal storm shutters was investigated and found to be about $50 per window, so we called on our welding shop for some reasonable answer. They had it. At a cost of $144 for labor and $127 for material, 24 four foot by six foot storm screen frames were made, painted, and installed. The frames were made of one-fourth inch by one and one-half inch flat iron four feet wide and six feet long with a cross member in the middle. One-half-inch mesh hail screen was soldered to the frame. Two one-fourth-inch lag screws at the top and one at the bottom were added to secure the storm screens in place.

The storm screens as installed remain in place the year around and do not detract from the appearance of the building.

The screens were made by C. T. Carpenter, R. V. Rogers, U. H. Mitchell, Harvey Reed, and J. W. Jones--all Skilled Laborers.

Hail screens on Resident Engineer's office at Abilene.

Panamanian Road Building

A.R. Kelley, Senior Resident Engineer
District 14

Vacationing motorists who have visions of traveling down the Pan American Highway all the way to interesting spots in Central South America had better defer any such plans for quite a while. Sections of the highway below the Mexican-Guatemalan border are not yet ready for pleasure travel and a trip over the entire route would require such preparation and equipment as would be necessary in a major expedition or adventure. Contrasting the dream of natural beauty of ranges and valleys, occasional views of the placid Pacific, Spanish colonial architecture, and colorful native life unfolding along the route is the picture of travelers bogging down in mud or sand, being stopped by landslides or unbridged rivers too deep to ford, or seeing the highway disappear into mere trails.

The purpose of my trip to the Republic of Panama, sponsored by the International Road Federation, was to assist in the development of plans and specifications for asphalt surfaces. However, upon arrival this was broadened to include suggestions and recommendations for organizing an efficient maintenance setup—including personnel, equipment, and materials. They also asked for a survey of the streets of Panama and Colon concerning surfacing problems.

The Republic of Panama has 201 miles not yet surveyed on the Pan American Highway route. Although 335 miles have been opened for traffic, only 178 miles are passable the year round. The remaining mileage is usually closed during October and

November, the rainy season. The alignment and grades are excellent, considering the rough terrain the road traverses. Bridges and approaches are designed for high water but range in width from ten feet seven inches to twenty-four feet. The Republic badly needs a system of roads throughout the several provinces. They have 125 miles of concrete pavement, 215 miles of asphalt surfacing, 500 miles of gravel surface, and 500 miles of dirt road. They plan, under a four-year special program, with state forces and modern equipment now being delivered, to rehabilitate the 215 miles of asphalt surfacing and the 500 miles of gravel surface by the addition of crushed base material and asphalt surfacing. Excellent road-building materials are in evidence in all sections of the country. Modern equipment and methods will eliminate to some extent the machete, the universal tool, now being used to cut grass and other vegetation along the highway right-of-way, trim lumber for bridge work, and in isolated sections, crush stone to be placed in mud holes by hand.

A.R. Kelley in Panama. He says, "On a dark night 24 hours prior to my intentions on them, some unscrupulous person stole this stalk of bananas."

Cattle being driven along the Pan American Highway midway between Panama City and the Costa Rican border.

The Republic of Panama has a Minister of Public Works who directly supervises highways, airports, and docks. Highways include all city streets and other public roads. About two years ago a president was elected for a four-year term on the platform for a better Highway Department which was to start a program of new roads, rehabilitation of existing roads, and the setting up of a maintenance system. Finances for such a program were not available locally, so the President, the Director of the Panama Highway Association, and a local businessman made application to the World Bank in New York for a $10,000,000 loan to be supplemented by $6,000,000 in Panamanian materials, labor, and equipment to finance a four-year program of construction, rehabilitation, and maintenance. The loan was granted on certain conditions, one of them being that the entire program would be supervised by a group of five foreign engineers. The President was assassinated last year and the Vice President assumed the office of President.

President Arias is 38 years old, educated in the United States, and very democratic. He is pledged to

Cable suspension bridge over Rio San Pablo on the Pan American Highway. Width is twelve feet, length approximately 1,000 feet.

A beautiful white sand resort beach 75 miles west of Panama City.

A favorite native method of transportation. Ox cart on the highway near Aguadulce.

Native life ten miles west of Santiago on the Pan American Highway.

carry out the program of the former President and is working very closely with the Panama Highway Association and the engineers supervising the program. The five-man commission responsible for the program is composed of the Executive Director, Chief of Operations, Administrative Director, Equipment Specialist, and Chief of Stores.

The organizational setup of the Panama Highway Department consists of three divisions, each having a total of 440 to 450 miles and including the streets, airports, and docks in their particular areas. They have a Division Engineer, Maintenance Engineer, Equipment Supervisor, and Laboratory Engineer heading each division. A Maintenance Engineer is in charge of maintenance only at subsections located in each of the eleven provinces of Panama.

Weather conditions in Panama are definitely not severe. The temperature ranges, on both coastal plains, from 65 to 85 degrees and varies from 50 to 65 degrees in the chain of mountains traversing the Isthmus. Rainfall on the Pacific coast averages 70 to 80 inches per year and on the Atlantic coast 140 to 150 inches, and at least

60 per cent in all sections falls in October and November. The dry season is December to March inclusive. Drinking water is available in every town and a majority of the dwellings, modern and ancient, are not equipped with screens or glass due to the scarcity of flies and mosquitoes.

The interior is picturesque beyond description, enhanced to no little extent by native Panamanians who are gay, fiesta-minded, rest between 12 noon and 2 P.M., gather in nicely dressed groups in every town at night, and are very friendly. But due to road conditions, tourist travel is rarely attempted other than in the immediate vicinity of Panama City.

Economic advancement would be unlimited if systems of roads were built and maintained into the interior. Cattle, dairy farms, vegetables, coffee, all kinds of fruit and nuts, and rice are in evidence in every section.

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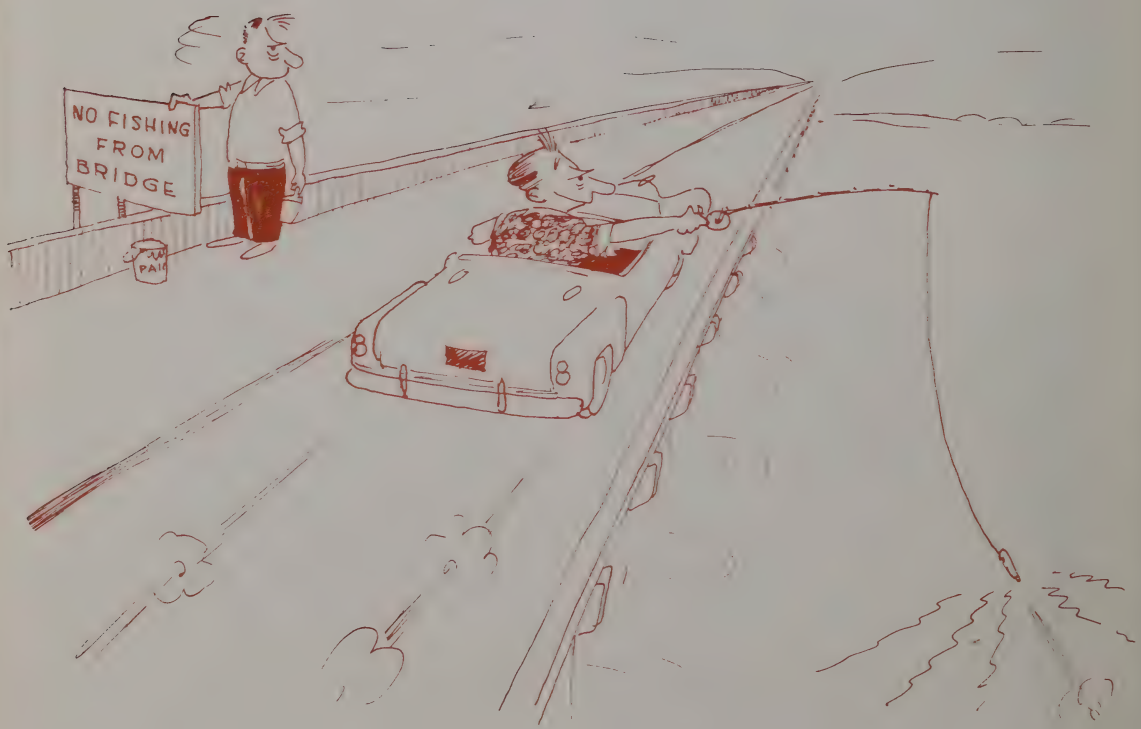
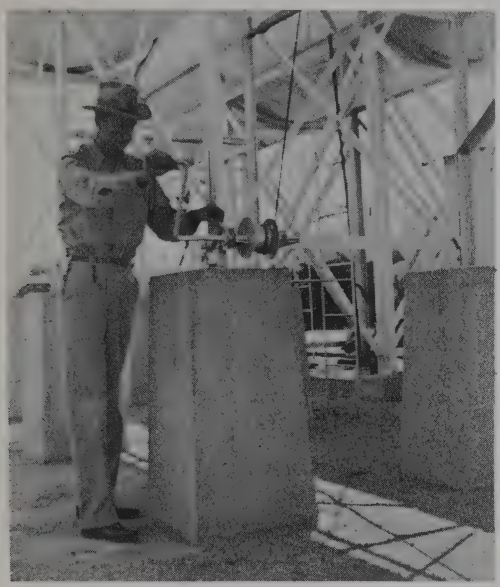


devices for asphalt tanks

R.N. Jennings, District Maintenance Engineer
District 7

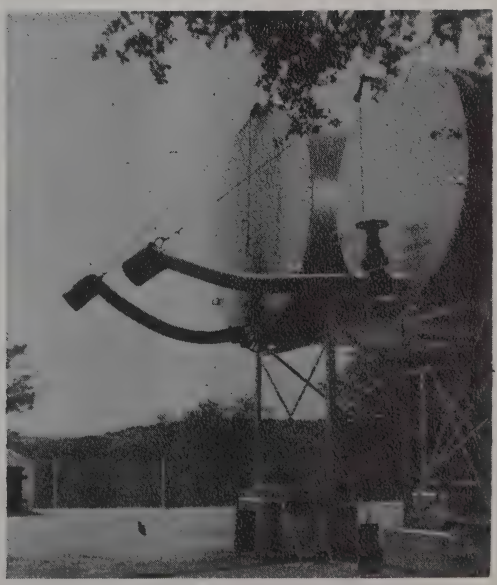
Pictured are devices which have been placed on asphalt tanks in District 7 to make the storage and handling of asphalt used in maintenance operations easier and more convenient.



Windlass used to raise and lower outlet hose.

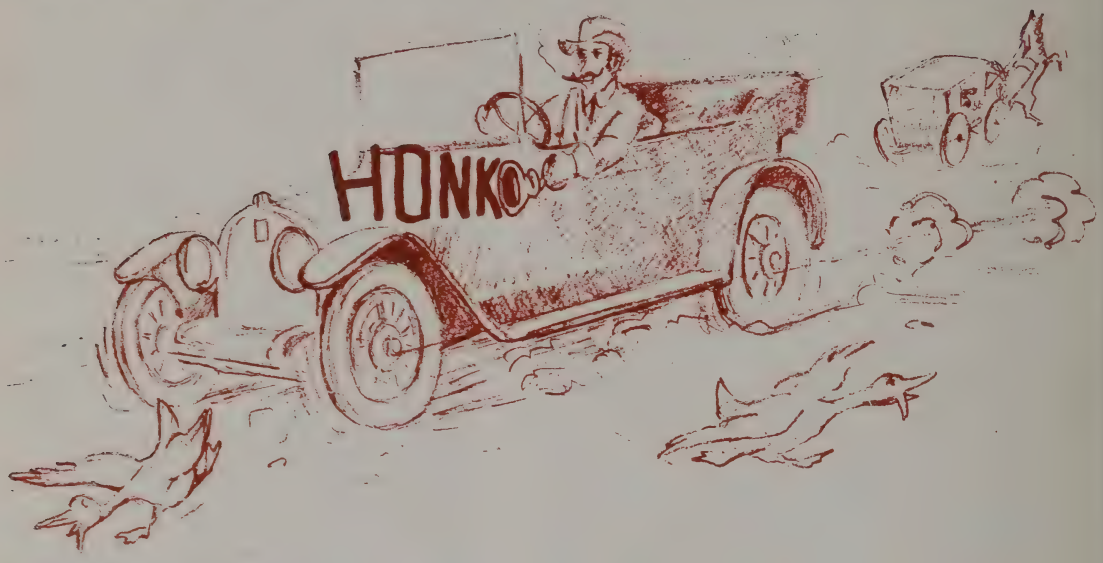
Two-inch hose outlet for loading barrels.

Float in tank measures asphalt.



Counterweight used to raise and lower outlet hose.

SOUND YOUR WHISTLE



With approximately twenty recipients of 35-year awards among Department employees at the present time, more and more of us are reaching the point when we can say "Remember when..?" Thirty-five years have seen a lot of changes in Texas and in its highway system, and no one would want to go back to the good old days of pushing his Model T up a hill and coasting down the other side, or borrowing a farmer's mules to pull Mr. Ford's contraption out of the mud holes.

To become eligible for federal aid under the Federal Aid Road Act of 1916, the State Legislature passed a law creating the Texas State Highway Department on April 4, 1917. This new state department was assigned the task of untangling the roads that the then 253 counties had been building hit-or-miss and creating a system of highways that went from someplace to someplace. The past 38 years have been so occupied with building this system that today Texas can point with pride to one of the finest networks of roads in the nation.

These musings on the beginnings of the Highway Department were called to mind by M. B. Hodges, District Engineer at Del Rio, who recently sent in a 1917 copy of the "Laws Relating to the Use of the Public Highways of Texas." The 43-page booklet was brought to his attention by Charles Miller Jr., Equipment Supervisor in District 22.

Containing a surprising number of sections that sound completely at home in 1956, the pamphlet has others that recall the days when "get a horse!" was a favorite expression and when 25 miles an hour was considered demoniac speed.

"The sum of ten thousand dollars, or so much thereof as may be necessary, is hereby appropriated out of the general revenue of the State, not otherwise appropriated, to purchase the necessary office equipment, to provide the identification numbers and distinguishing seals herein required for motor vehicles and motorcycles for use on or before July 1, 1917, and to meet the general expenses of the said State Highway Department up to

and including June 30, 1917; and such sum as may be drawn from the State Treasury shall be repaid to the State from the collections of the first year." At the end of the 1954 fiscal year the total assets of the Department were set at over $99 million.

The pamphlet sets the highway speed limit at twenty-five miles an hour; eighteen miles an hour in built-up areas; fifteen miles in cities of less than 40,000 population; and ten miles per hour in cities of more than 40,000. With great foresight however, the planners did make fire department vehicles, police patrols, Red Cross ambulances, and physicians on calls exceptions to these limits.

Section 22 states that "Motor vehicles in passing each other on the highways shall slow down their speed to fifteen miles per hour." The books get really adamant when it comes to bridges — "If any person shall ride or drive over any bridge belonging to any county, or to any municipal or private corporation, faster than a walk, he shall be fined in any sum not exceeding $100." And in 1917, $100 was a lot of money.

"The labor of State prisoners may be utilized in construction or maintenance work on any road designated by the State Highway Department as forming a part of the system of State highways, upon such terms as may be agreed upon by the State Highway Commission and the State Prison Commission and approved by the Governor of Texas." However, except in a few isolated cases, this clause was never taken advantage of, and chain gangs have never been seen on the highways of Texas as there were and are in many other southern states.

Even the noise-making department was taken care of—"Every motor vehicle shall be equipped with a bell, gong, horn, whistle or other device in good working order, capable of emitting an abrupt sound adequate in quality and volume to give warning of the approach of such motor vehicle to pedestrians and to the rider or driver of animals, or of other vehicles and to pedestrians entering or leaving street, interurban or railroad cars. Every person operating a motor vehicle shall sound said bell, gong, horn, whistle or other device whenever necessary as a warning of danger but not at other times or for other purposes," - - - How's your whistle working?

● ● ●

COMING ATTRACTIONS . . .

Several cities in the state have been holding elections to authorize the sale of bonds for purchasing much-needed highway right-of-way. The March issue of TEXAS HIGHWAYS will feature the first of a series of articles by District Engineers on their experiences concerning these elections. Watch for it.

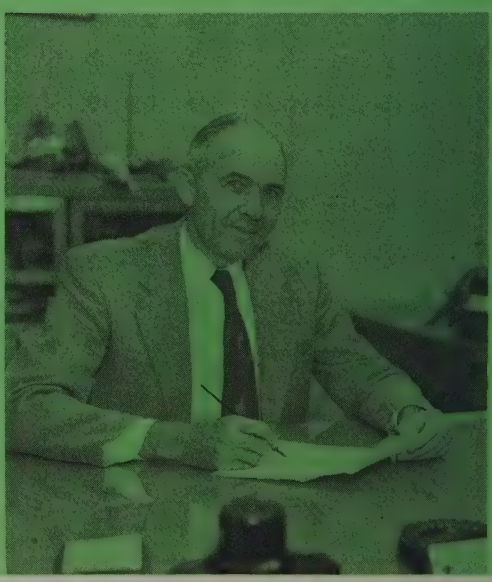
THE DISTRICTS

DISTRICT

The eight counties of the Beaumont district lie partly in the Big Thicket, partly in the piney woods, and the remainder in the Coastal Plain. The area is also included in some of the fastest growing territory in the state. The deep water port of Beaumont is one of the state's industrial centers and claims a population jump of 12,000 in the last five years.

One of the largest highway projects in the state at the present time is the State 73 expressway which will connect the cities of Houston, Beaumont, and Port Arthur. Other highways throughout the District are being improved and modernized as rapidly as funds will allow. The present Beaumont highway district was organized in 1932 and today its approximately 600 employees have over 1,500 miles of roads in their charge.

The entire area has come a long way since the nation's first big oil strike at Spindletop in 1901 and today the petroleum and chemical industries are well balanced by the District's lumbering, livestock, and farming economy.



W.E. Simmons, District Engineer, E.D. Parmer, Assistant District Engineer, A.F. Fore, Traffi

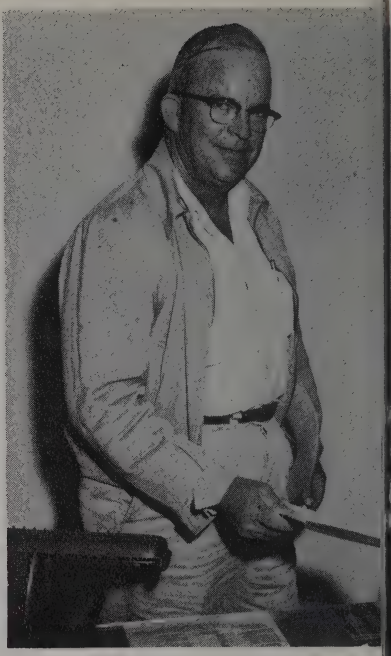
20 paper work.

PASS IN REVIEW

20

esigner, and Milton Hayes, Senior Maintenance Superintendent, are all kept busy with District

Ken Nagai, Senior Designing Engineer, and C.H. Brown, District Construction Engineer, discuss right-of-way problems.



J.P. Jones, Senior Maintenance over office business with Joh

The Beaumont urban expressways office is concerned with superhighways, and here Gerald V. Stackpole, Rodman, Tillman D. Jones and J.T. Middleton, Resident Designers, and R.W. Hawn, Senior Engineering Assistant, go over some of the problems.

Going over payrolls is part of th Accountant, and Disa Marie Nel

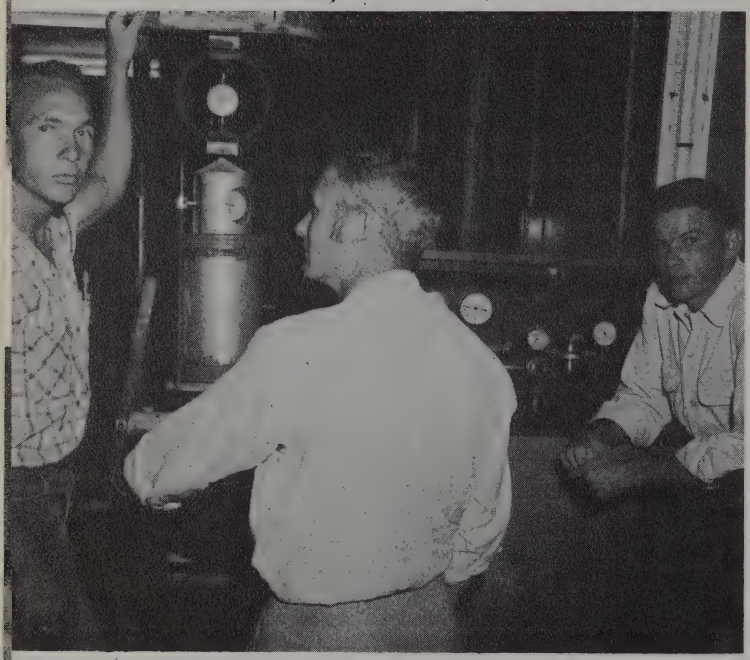
Foreman from Cleveland, goes
DeLacie Jr., Senior Accountant.

Taking notes on estimates for the Beaumont expressway project are Frances Lopez, Junior Clerk, Harry Winters, Senior Engineering Assistant, L.E. Hudson, Senior Draftsman, and R.W. Cardwell, Senior Engineering Assistant.

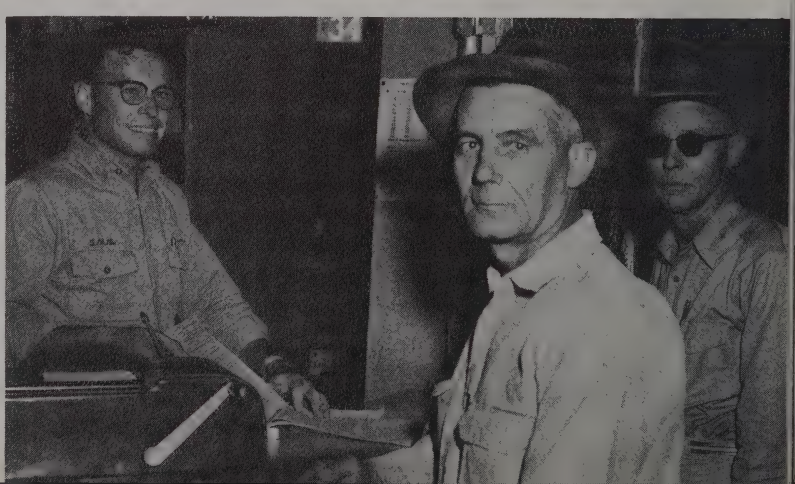
job for Harry Gray, Chief District
son, Senior Accountant.

These two Senior Maintenance Foremen were in the District Office on business. C.A. Crow is from Sabine Pass and L.M. Bilbo from Orange.

These three young ladies are kept busy with paper work. They are Marjorie Jackson and Elida Gonzalez, District Office Clerks, and Jo Lynn Holbrook, Junior Office Clerk.



W.A. Roberts, Junior Inspector, R.W. Dowden, Chief Inspector, and George A. Erwin, Laboratory Assistant, are running a triaxial test.



The supply room is always a busy place. J.A. Greer, Skilled Laborer, helps Allan S. Manuel, Semi-skilled Laborer, and C.N. Stephenson, Skilled Laborer.

WELDING SKILL

Clarence Rhea, Senior Field Engineer
Bridge Division

Our 25 districts, in varying extent, use arc-welding in the construction and repair of bridges, in equipment maintenance, and in construction of special "brain children" which are thought up by resourceful maintenance men to perform special jobs.

Successful welding depends upon two separate factors, both of which are essential. These factors are the engineering development of the welding procedure with all of its technical features, and the skill of the welding operator himself.

Among the features of the welding procedure are (1) quality of base metal, (2) type of joint and its preparation, (3) type and size of electrode to be used for each bead and the proper welding machine for the electrodes, (4) sequence of making the various welds, and (5) requirements, if needed, for preheat and post heat.

The skill of the welding operator makes it possible to have the above described procedure properly carried out. This skill is the ability to make sound welds in the particular types of joints involved, welding in the positions in which the joints must be made, and using the particular electrode which is specified. The skill is the result of natural aptitude and many months of practice and study. It is apparent that ability to weld in the flat, or down-hand position, can be developed before a man can weld in the overhead position. Different techniques are also involved in welding in the vertical and horizontal positions.

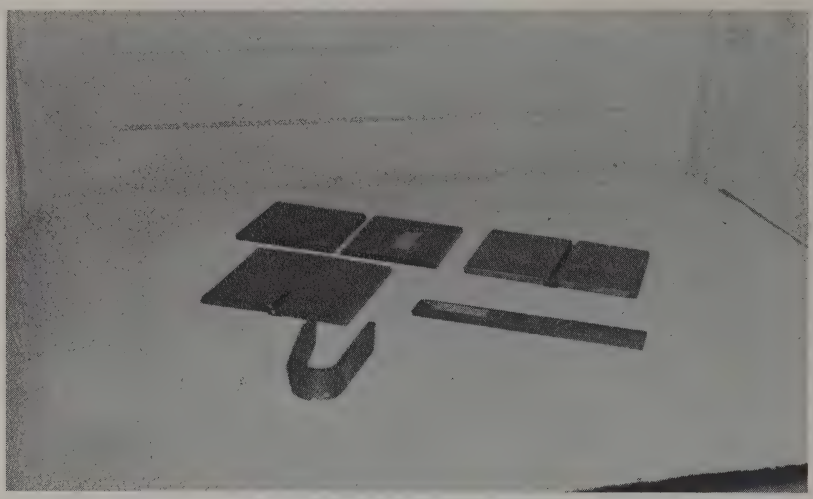
A sound weld is solid metal—free from gas pockets or foreign particles such as slag—of proper shape, and well fused into the parent metal without a brittle zone.

The districts are now adopting a program of checking the skills of their weldors in order to reduce the possibility of assigning a weldor to perform work for which he is not qualified. Equipment and Procurement and Bridge Divisions are helping with this program.

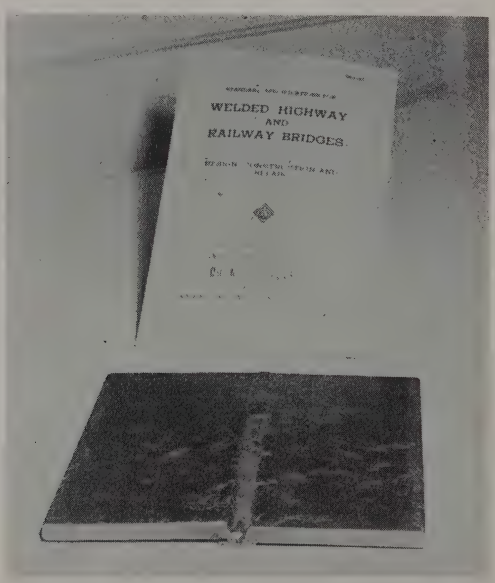
There is a simple test to determine

the soundness of a sample weld. The test is based on the fact that a sound weld, made with the proper electrodes and joining two mild steel plates, will be a ductile material which will pass a bending test without cracking or fracture. An unsound weld will crack or break.

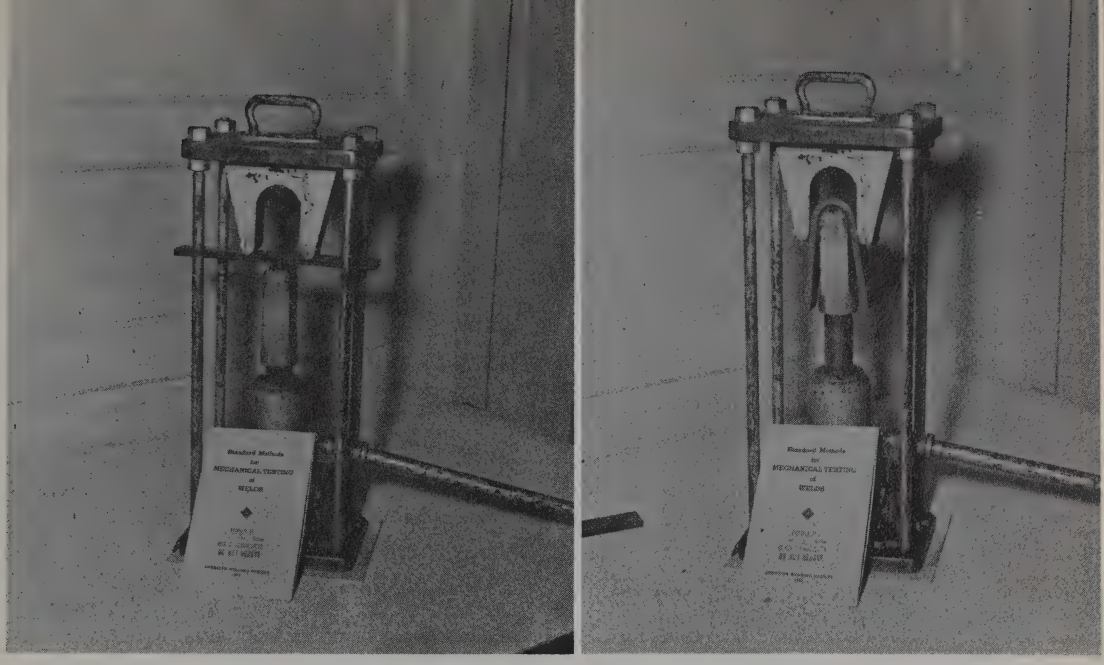
First tests are devised to cover fundamentals and all positions, working with mild steel, which is the easiest to weld. Later testing will deal with more difficult procedures such as those required in handling alloy steels, high carbon steels, cast iron, stainless steels, and hardfacing.



This shows five stages of testing. Upper left, the unwelded plates. Upper right, the plates tacked to back up strip. Center left, the partially completed weld. Center right, the strip cut from center and machined. Lower specimen is the completed bend showing sound weld.

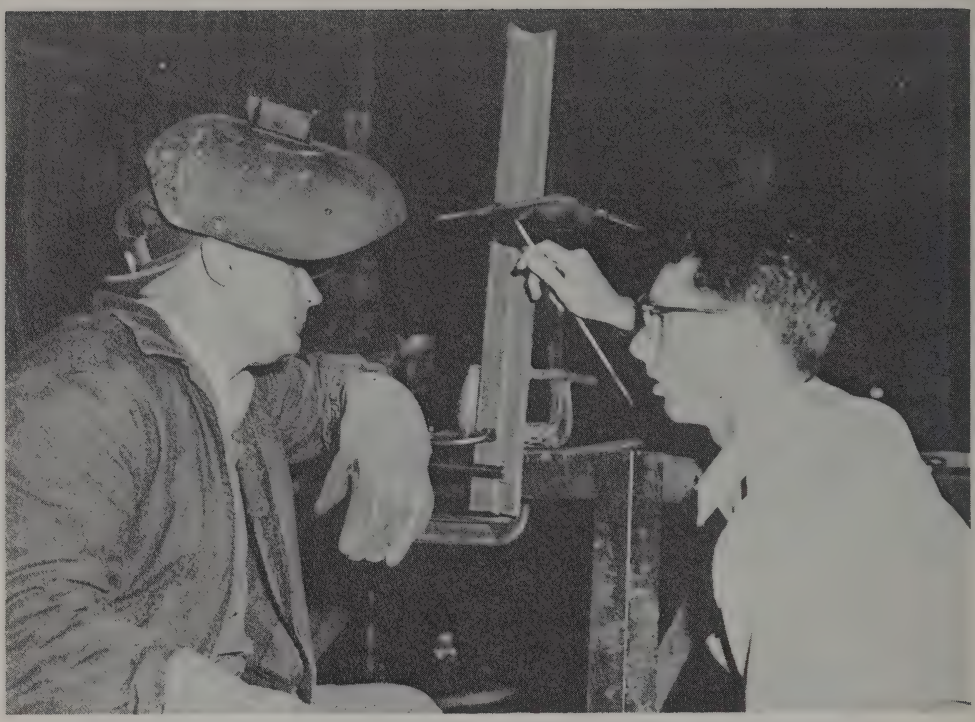


The above plate shows three stages of welding in a test plate. The lower portion shows the first root pass, the middle third shows the second bead, and the top third shows the completed weld.



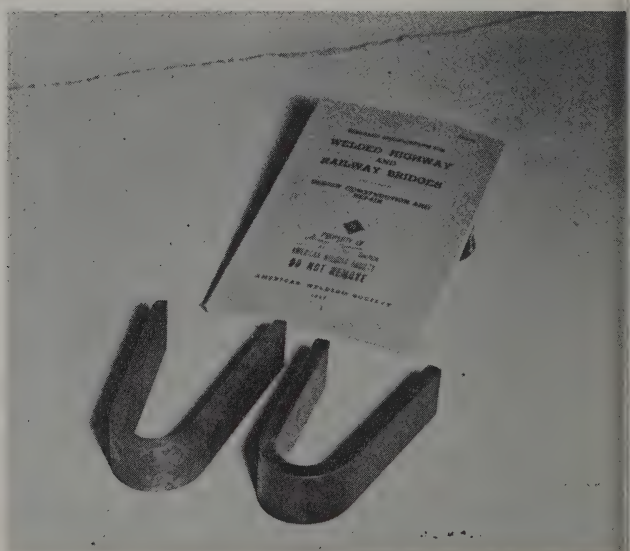
Pictured is the test-jig for bending the specimen after being cut out and machined. The one and one-half inch machined strip is shown at left before being bent. At right is the same test plate after being bent to 180 degrees.

J.K. Nash, District 14 Equipment Supervisor, left, discusses with Frank Marx, District 14 Weldor, the test strip after bending. No cracks or tears are evident.



Ed Hill, Bridge Division Welding Inspector, shows Marx proper method of making overhead test.

Three test strips after bending to failure. Cracks and tears in weld are evident. The two lower strips failed quickly before bending very far. The top test did not fail until nearly reaching the complete bend.



The two plates on the right are satisfactory.

Drivers are apparently becoming more cautious about exceeding the speed limit. Results of the Highway Planning Survey's 1955 speed survey show that only 12.6 per cent of the vehicles observed at all stations this year were traveling faster than 60 miles per hour, while 16.5 per cent were exceeding this limit at the time of the survey last year.

The survey was made at 24 selected locations on the rural state highway system with radar apparatus to measure the speeds. Of all the locations at which speeds were observed, the highest speed was noted on U.S. 281 between San Antonio and the Rio Grande Valley south of George West. At this point, the average speed of all vehicles was 60 miles per hour. The nearest rival to this location was on U.S. 90 near Sealy between San Antonio and Houston where the average speed was 57.2 miles per hour for all types of vehicles. The chart below gives an over-all picture of survey results covering all 24 stations.

TEXAS HIGHWAY DEPARTMENT

TEXAS HIGHWAY PLANNING SURVEY

SPEED SURVEY

Station No. All Stations

Weather

Location _____

	Year	Passenger Cars	Single-Unit		Truck Combinations		Total Trucks	Busses	All Vehicles
			Panel Pickup	Other	3-Axle	4-Axle			
Average Speed	1954	55.7	48.3	45.9	45.7	47.8	47.1	55.6	53.4
	1955	55.5	49.1	47.1	46.1	47.3	47.7	57.6	54.0
Per cent exceeding 35 miles per hour	1954	98.8	94.0	93.1	91.8	94.7	93.6	98.9	97.5
	1955	99.4	98.6	98.4	97.9	98.0	98.2	99.2	99.2
Per cent exceeding 40 miles per hour	1954	94.1	78.2	71.5	70.2	81.4	76.0	92.6	89.4
	1955	96.6	93.3	90.1	85.7	87.1	89.5	98.3	95.2
Per cent exceeding 45 miles per hour	1954	87.2	63.0	50.9	50.7	64.7	58.3	88.4	79.7
	1955	93.6	81.9	69.6	61.9	68.0	72.1	97.5	89.4
Per cent exceeding 50 miles per hour	1954	66.8	32.8	21.6	23.3	31.2	28.0	69.5	56.7
	1955	74.3	34.0	17.4	13.3	23.2	24.2	93.4	64.5
Per cent exceeding 60 miles per hour	1954	21.1	5.3	1.8	1.5	3.3	3.4	21.1	16.5
	1955	15.5	0.9	0.8	0.6	0.5	0.7	19.0	12.6

Personnel Changes

H. L. Arno, Director of Personnel

District 2

County Residency, Fort Worth: Jack Green, Resident Engineer, changed to James B. Green, Senior Resident Engineer, January 1, 1956.

District Headquarters, Fort Worth: Jack G. Hamm changed from Office Engineer to Senior Designing Engineer January 1, 1956.

Expressway, Fort Worth: George T. Jefferson changed from Designing Engineer to Senior Designing Engineer December 1, 1955.

Expressway, Fort Worth, to District Headquarters, Fort Worth: Wilton N. Hammond, Designing Engineer, transferred as Senior Resident Engineer December 1, 1955.

District 4

Expressway, Amarillo: Pete Styner changed from Designing Engineer to Senior Designing Engineer November 1, 1955.

District 12

County Residency, Bay City: John H. Robertson, Senior Resident Engineer, resigned November 30, 1955.

District Headquarters, Houston: George P. Munson Jr., changed from District Construction Engineer to Assistant District Engineer December 1, 1955.

District Headquarters, Houston, to Houston Urban Project, Houston: Seth P. Gilbert, District Maintenance Engineer, transferred to the Houston Urban Project as Senior Resident Engineer December 21, 1955.

District 15

Expressway, San Antonio: Wilbur C. Raby changed from Supervising Field Engineer to Assistant Expressway Engineer January 1, 1956.

District 16

County Residency, Karnes City: James T. Chapman changed from Resident Engineer to Senior Resident Engineer January 1, 1956.

District 18

District Headquarters, Dallas: Oliver C. Anderson changed from Assistant District Engineer to Senior Designing Engineer January 1, 1956.

District 20

County Residency, Orange to District Headquarters, Beaumont: Ken Nagai, Senior Resident Engineer, transferred as Senior Designing Engineer November 16, 1955.

District Headquarters, Beaumont: Jefferson D. Reagan Jr., Senior Resident Engineer, accepted retirement November 30, 1955.

Bridge Division, Austin

Farland C. Bundy changed from Designing Engineer to Senior Designing Engineer November 1, 1955.

Land Service Roads Division, Austin

Fred Stutz changed from Designing Engineer to Senior Designing Engineer January 1, 1956.

Road Design Division, Austin

William B. Averyt changed from Senior Office Engineer to Supervising Designing Engineer January 1, 1956.

Walter R. Davis, Supervising Designing Engineer, died December 3, 1955.

Cleveland S. Kinney changed from Senior Route Engineer to Supervising Route Engineer January 1, 1956.

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Paper Bridges?

Now they're building bridges with paper. Kansas has come up with this new idea in bridge building on a hollow reinforced concrete bridge now under construction. From all outward appearances the completed bridge will look exactly like any other bridge of similar design. But this one contains one thing different. Embedded in the concrete slab are hollow paper tubes from nine to fourteen inches in diameter and up to fifteen feet in length. Placed longitudinally through the slab, the tubes are rigid enough to prevent their collapse when covered with concrete and are plugged at the ends. They are designed to lessen the dead load of the structure.

(Highway Highlights)

In an effort to eliminate expensive hand mowing and hand cutting around signs and guard posts, this District has been experimenting with a herbicide to eradicate weeds and grasses. We believe that we have found a very economical and effective method in using a product containing a minimum of 61.5 per cent boron trioxide. This herbicide is a nontoxic, noncorrosive, and nonflammable soil sterilant.

Applications were made in this District in the winter of 1953 and 1954 by removing the vegetation from a three-foot-diameter circle around posts, spreading the dry herbicide on evenly, then covering the treated areas with the weed and grass residue previously removed. The covering was necessary to prevent any movement of the chemical and would allow subsequent rains to leach the herbicide into the soil.

Winter applications are desirable for this gives the material time to be dissolved by winter rains and carried into the soil before spring growth starts. We found that the most economical and effective rate was one and one-half pounds of the herbicide for each post. The chemical was applied safely by hand from a bucket without any special equipment. Reasonable care was exercised by avoiding treatment of areas where the roots of desirable trees or shrubs underlay the soil.

The cost of the chemical for treating each marker was slightly over 6 cents. Cost comparisons show 36 man-hours were required for each hand cutting of certain areas inaccessible to the mower with six cuttings per season requiring 216 man-hours. Thirty-six hours were required to apply this chemical over the same areas resulting in the eradication of the weeds and grasses for one year or longer. The length of time the herbicide remains effective in the soil depends on rainfall, types of soil and vegetation, and other factors.

We feel that we have found a chemical that will eliminate undesirable vegetation without the risk of erosion and we also feel that it will save us many man-hours of hand cutting labor throughout the growing season.

William C. Woodard, Landscape Inspector
District 2

weed and grass control

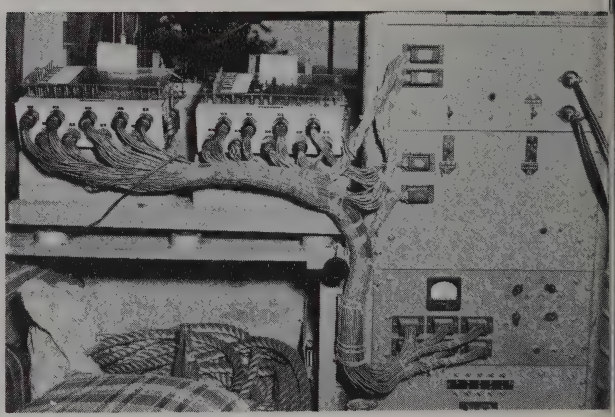
US
67
144
TEXAS
CLEBURNE 22
MERIDIAN 25
GLEN ROSE

Pavement Widths vs. Vehicle Speeds and Placements

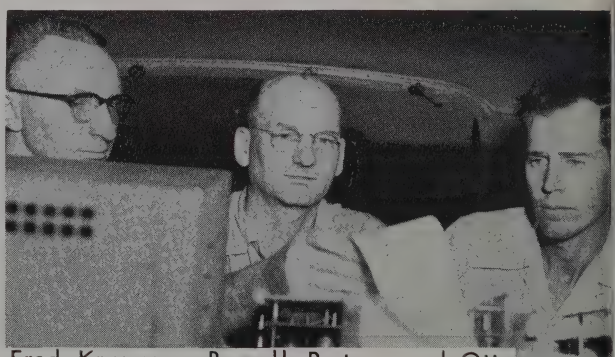
T.S. Huff, Engineer,
Road Design Division

A study was recently conducted on several Texas highways to determine the relationship, if any, between lane width and placement and speeds of vehicles during the daylight hours. The survey was made on two-lane, low-volume, rural highways, in an effort to better determine the probable effects on safety and maintenance costs of lane widths twelve feet or over. The study was made by the Road Design Division and Highway Planning Survey Division personnel, jointly with the Bureau of Public Roads. The Bureau of Public Roads provided the equipment and two engineers, A. Taragin and Bernell Porter.

There were two separate trucks housing survey equipment used in the research which were placed out of sight of motorists. Pneumatic tubes were placed on the pavement and the impulses from vehicles crossing the tubes were transmitted to the apparatus, which coded the width the vehicle was traveling from the center stripe, and its speed. In addition, the recording equipment was able to separate passenger vehicles from trucks and buses, due to the time element in the vehicle wheels crossing the tape. Manual counts and notes were made when one vehicle passed



Apparatus in Bureau of Public Roads truck used to record placement of vehicles on highway and their speed.



Fred Krugman, Bernell Porter, and Otto Wehring observe the truck apparatus at work. Porter is with the Bureau of Public Roads, the others are Highway Planning Survey employees.

Truck containing recording apparatus is concealed from highway to keep it from distracting drivers.

View of strips which transmitted speed and placement data to automatic recording equipment.

the other traveling in the same direction within 1,250 feet of the observation station.

Studies were made at twelve different points in the vicinity of Austin, which provided a cross section of both traffic and highways. Listed below are some of the conclusions indicated by the study.

1. The probability of head-on collisions and running off the edge of pavement appeared to decrease with the increase in lane width.

2. The probability of pavement edge failure apparently decreased with the increase in lane width.

There was no correlation between speed and lane width. Sealed shoulders were associated with higher speeds but it could not be determined if sealed shoulders caused an increase in speed.

ED. NOTE: This study and findings have been compiled and released in a manual which reflects details and other technical data not covered in this article. Limited copies for official use only may be obtained from the Road Design Division, Austin 14, Texas.

FIRSTS IN TEXAS HIGHWAYS

. . . anybody disagree?

A search of records, supplemented by memories, revealed three major "firsts" in the history of the Texas Highway System. S. D. "Doug" Johnson, Senior Federal Aid Engineer, Aid Division, came up with the answers to the first construction and paving job. William L. Garrard, Senior Office Engineer, Construction Division, supplied TEXAS HIGHWAYS with the data relative to the first farm-to-market road built in Texas.

The first highway constructed under the auspices of the Texas Highway Department was a twenty-mile section of untreated flexible base from Falfurrias to Encino. This highway was sixteen feet wide. This section of highway was started in October, 1918, and finished in June, 1920, at a cost of $95,852.85. The highway was financed by federal, state, and county funds (federal, $30,500.00; state, $15,135.03, and county, $50,217.82). This is in general the present route of U.S. 281. The Resident Engineer was H.S. Bedell and the contractor was Brooks County.

The first highway hard-surfaced under the auspices of the Texas Highway Department was the 25-mile section of highway from the Travis County Line to the Comal County Line via Hays County. This section of highway was started in July, 1918, and finished in March, 1919, at a cost of $58,366.32. The highway was fifteen feet wide, with the single bituminous treatment surface being one-half inch thick. The highway was financed by federal, state, and county funds (federal, $27,745.42; state, $14,682.44, and county, $15,938.46). This was the route in general followed by present U.S. 81. The Resident Engineer was J. W. Puckett and the contractor was Hays County.

The first farm-to-market road constructed in Texas was the lateral or feeder "F" road built in Rusk County between Mount Enterprise and Shiloh, a distance of 5.8 miles. It was let April 20, 1936, as State Highway No. F, Control Number 462, Section 1, Job 1, WPSO 895-A, at a cost of $48,015.12. The project was sixteen feet wide and was completed in January, 1937. The Resident Engineer was E.M. Walker and the contractor was Gifford Hill Company.

. . . Letters like this must come to you rarely. Ordinarily the compulsion to write one comes to a man but too infrequently. But, after the wonderful experience on a trip my son and I made to Carlsbad Caverns this week I feel impelled to say these things.

We traveled over state highways, farm to market roads, and over U. S. Highways in both Texas and New Mexico and I can assure you that the Texas Highways are by far superior to any in the United States with the possible exception of the fabulous freeways.

Everywhere we went the roads were well maintained, wide enough for perfect safety for careful drivers, and well enough marked that sane drivers could be well warned of impending dangers and avoid them.

I was especially impressed by the warning signs. Every possibility that might affect driving was thought of, prepared for, and posted. The one I will never forget was the one warning us of wind currents as we drove through a particularly deep cleavage in a hill. Too, the constant postings of the miles before the next stop. Also the many roadside parks for the convenience of travelers. It made me proud to be a resident of Texas and to know that the Highway Department is constantly working to keep their part of the work in a safe and a sane manner.

There is no reason for having an accident in Texas except human carelessness or thoughtlessness!

Thank you for a good trip and keep up the good work. What we saw, you should be proud of and I know you are constantly endeavoring to improve that . . .

P. Milchan
Denton, Texas

. . . We disliked the lack of sufficient mileage markers between towns or cities. Also, markers should indicate East or West—especially at dead ends. Your speed limits and roads are wonderful . . .

Denver, Colorado

. . . We liked your wonderful highways, particularly the wonderful signs, warnings, and so forth. . .

Memphis, Tennessee

. . . Oklahoma with bad roads has a 65 mile per hour speed limit, however, you have 60 on good roads. I observed that few observed the 60 mile per hour speed limit. I wonder if you allow an extra five mile per hour grace (on good roads)?

Los Angeles, California

. . . R.W. Kutzer, state highway employee of Longview, stopped and helped us out of a very difficult and inconvenient situation when we had tire trouble. He would accept nothing for his own time and considerable work . . .

L. V. E. Irvine
Ruston, Louisiana

. . . We were impressed with the wonderful highways you have. They were some of the best we have ever driven on . . .

St. Joseph, Missouri

. . . We liked the wide, well-kept highways and the roadside parks. Also the courteous and friendly assistance of the man at the information bureau. . .

Metropolis, Illinois

. . . The caution signs, intersection warnings, and stop signs were too close to intersections. Highway route turn signs, alternate route signs, and other route signs were too close to turns, etc. . .

Lakewood, Ohio

IN MEMORIAM

J.C. Woolsey, Semi-skilled Laborer, Graham, Texas, was instantly killed November 18, 1955, when the loading machine he was driving to the warehouse was struck from behind by an automobile.

John Hoff, Instrumentman, Bellville, lost his life in the collapse of the bridge on State Highway 159 between Hempstead and Bellville on January 20, 1956.